LHC & CMS status

Konstantinos Kousouris
Fermilab - CMS Center

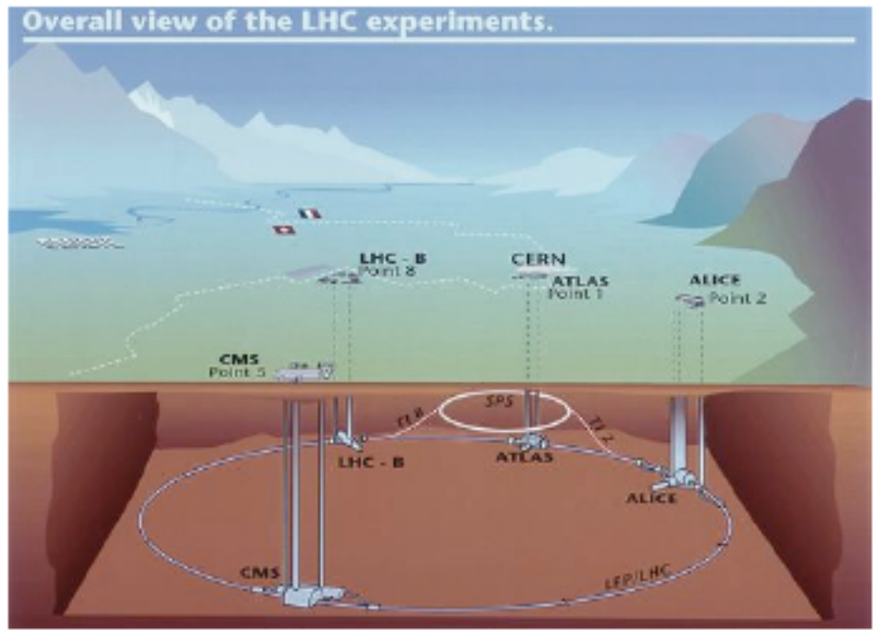
All Experimenters' meeting
Monday, 2 March 2009

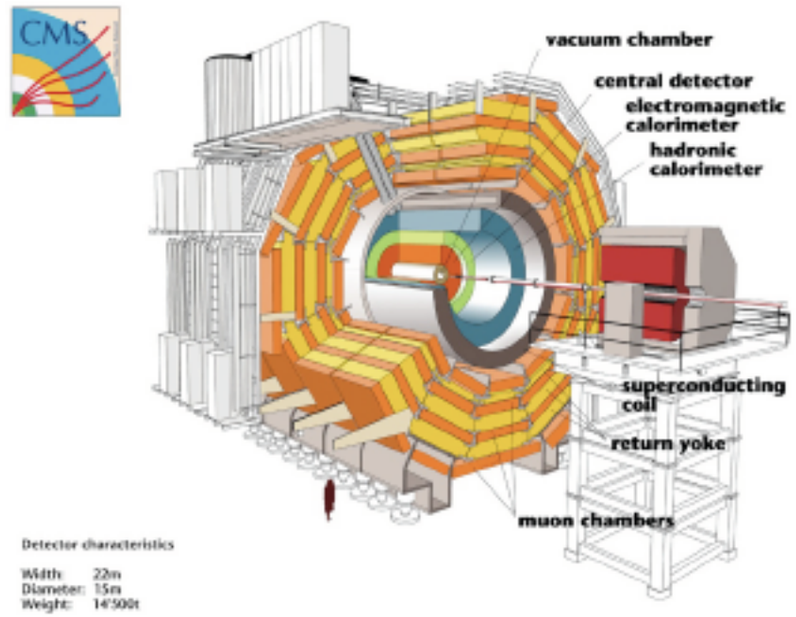
Outline

➡ **LHC status.**

➡ **CMS status.**

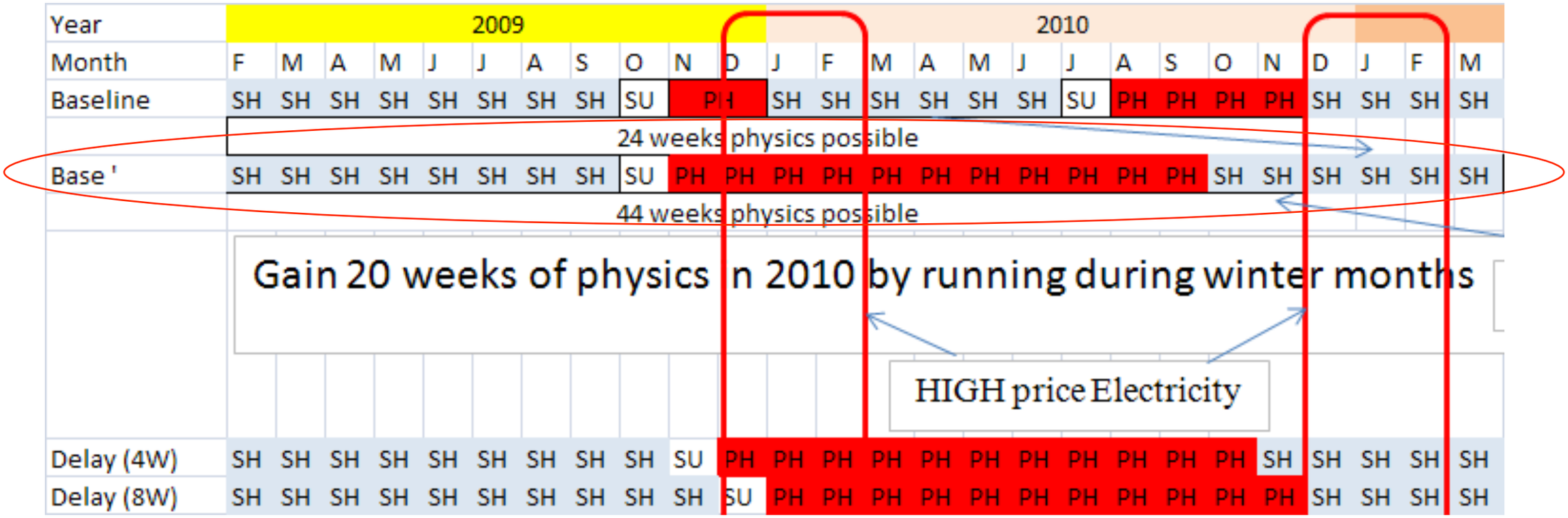
➡ **CMS commissioning w/o beam.**





LHC: Chamonix Conclusions (I)

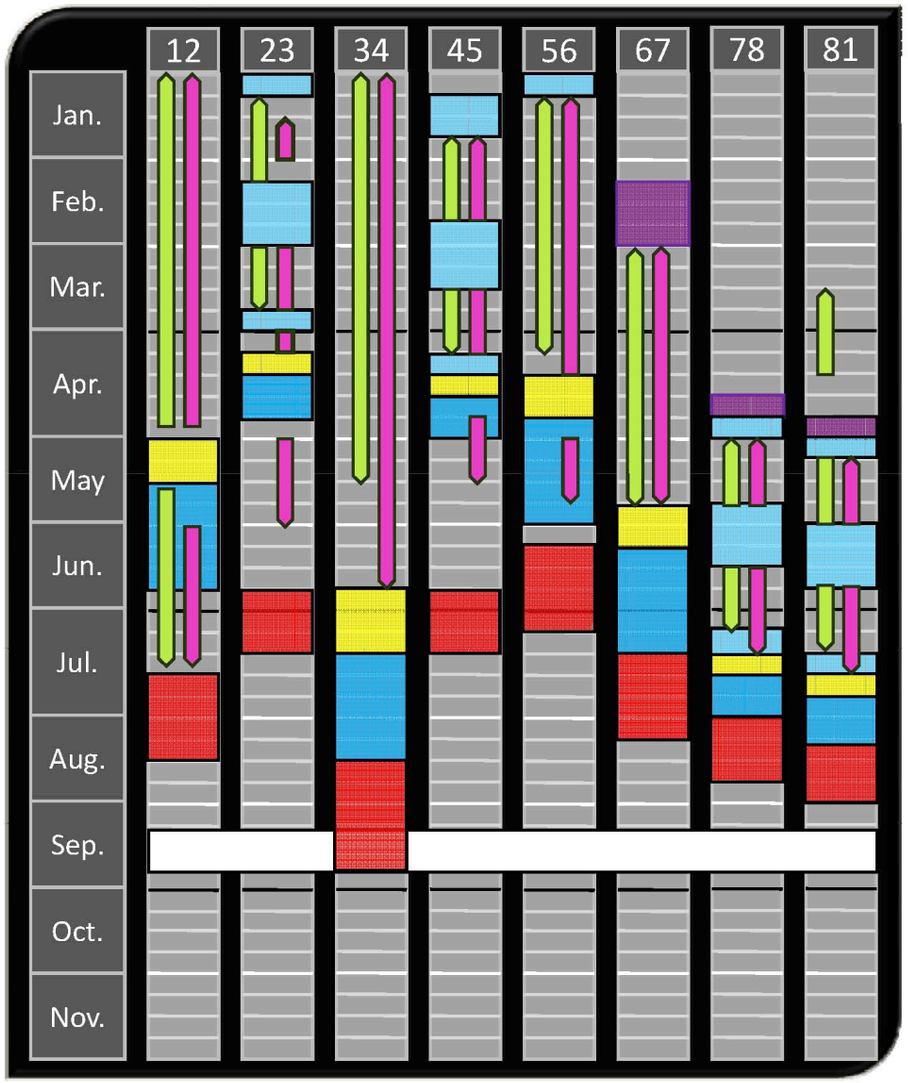
- **The new schedule delayed by six weeks wrt the previous:**
  - implementation of new enhanced protection system for the busbar and magnet splices.
  - installation of pressure-relief valves to reduce collateral damage in case of a repeat incident.
  - application of more stringent safety constraints.
  - scheduling constraints associated with helium transfer and storage.
- **Run during the Winter months (gain 20 weeks of Physics running independent of "slip").**
- **LHC should not be operated until the full Quench System is tested and operational.**



LHC: Chamonix Conclusions (II)

Shutdown 08-09

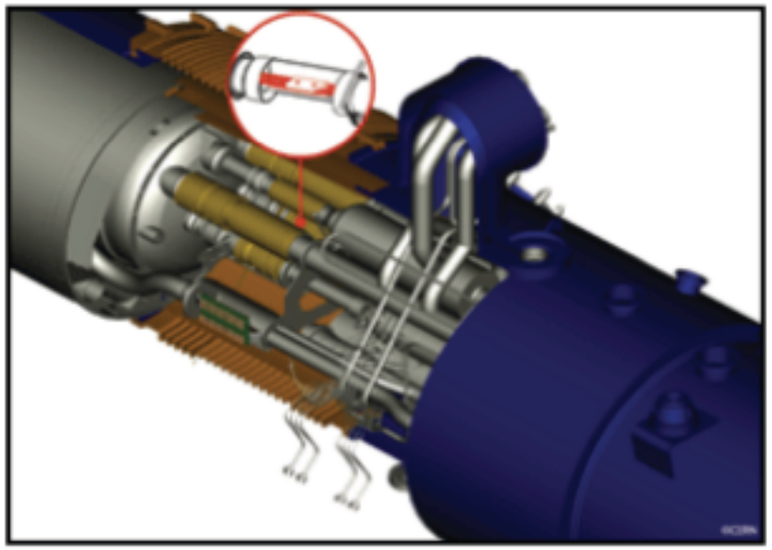
Key Drivers Maintenances Priorities Activities – service areas, LSS, Arcs **Schedule** Critical Points

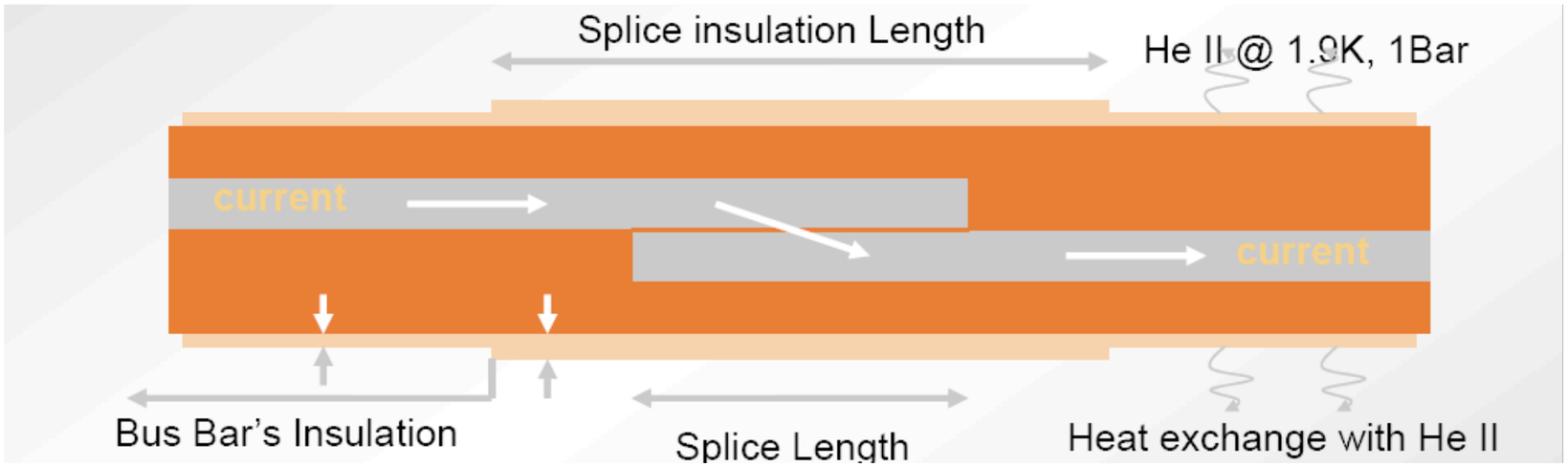


- Intermediate cool-down & QRL warm-up (Stand Alone)
- Activities
  - Arc
  - LSS
- Flushing & ELQA at warm
- Cool-down
- Powering tests
- Cold check-out

LHC consolidation news

- First dipoles fitted in SM18 with new pressure-relief valves.
- Next, the procedure applied to warmed-up sectors.
- Improved calorimetric method of measuring the inter-splice resistance (1 nOhm sensitivity).
- Work to improve anchoring of 104 Short Straight Sections.
- Sector 67 warming up to replace a dipole with internal 50 nOhm splice resistance.
- Dipole in S12 with 100 nOhm splice removed, opened and confirmed lack of solder in the splice.
- Start of massive campaign to re-analyze data taken during the previous cold testing checking for abnormal splice resistance.





LHC: 2009/2010 Run

- **DG's message on 10 Feb:**
  - first beams in the LHC at the end of September 2009.
  - collisions in late October.
  - short technical stop over Xmas.
  - run through to autumn 2010.
- **Machine Protection tested with beam (testing at 0.5 TeV energy steps).**
- **4 TeV, 5 TeV beams (no higher in 2010).**
- **Intensity limited until QPS symmetric mode is completely tested.**
- **Physics with 5 TeV beams.**
- **Estimated p-p integrated luminosity:**
  - during first 100 days of operation ~100pb^{-1}
  - during next 100 days of operation ~200pb^{-1}
- **Heavy ions towards the end of 2010.**

LHC: 2009/2010 luminosity

Approximate!!!

LHC 2009 - 2010 luminosity performance - estimate

A path to the total integrated luminosity quoted at Chamonix 2009 while keeping the total intensity to a reasonable level. Necessarily approximate.

Month	Comment	Turn around time	Availability	Max number bunches	Protons/Bunch	Min beta*	Peak Luminosity $cm^{-2}s^{-1}$	Integrated Luminosity
1	Beam commissioning							First collisions
2	Pilot physics, partial squeeze, gentle increase in bunch intensity, 40%	Long	Low	43	3×10^{10}	4 m	1.2×10^{30}	100 - 200 nb^{-1}
3		5	40%	43	5×10^{10}	4 m	3.4×10^{30}	~ 2 pb^{-1}
4	2.5% nominal beam intensity	5	40%	156	5×10^{10}	2 m	2.5×10^{31}	~13 pb^{-1}
5		5	40%	156	7×10^{10}	2 m	4.9×10^{31}	~25 pb^{-1}
6	9% nominal beam intensity, 75 ns	5	40%	936	3×10^{10}	2 m	5.1×10^{31}	~30 pb^{-1}
7	15% nominal beam intensity, 75 ns	5	40%	936	5×10^{10}	2 m	1.4×10^{32}	~75 pb^{-1}
8	15% nominal beam intensity, 75 ns*	5	40%	936	5×10^{10}	2 m	1.4×10^{32}	~75 pb^{-1}
9	15% nominal beam intensity, 75 ns*	5	40%	936	5×10^{10}	2 m	1.4×10^{32}	~75 pb^{-1}
10	Ions							
							TOTAL	**~300 pb^{-1}**

Max number of filled bunches in the LHC is 2808=3 x 936

CMS status

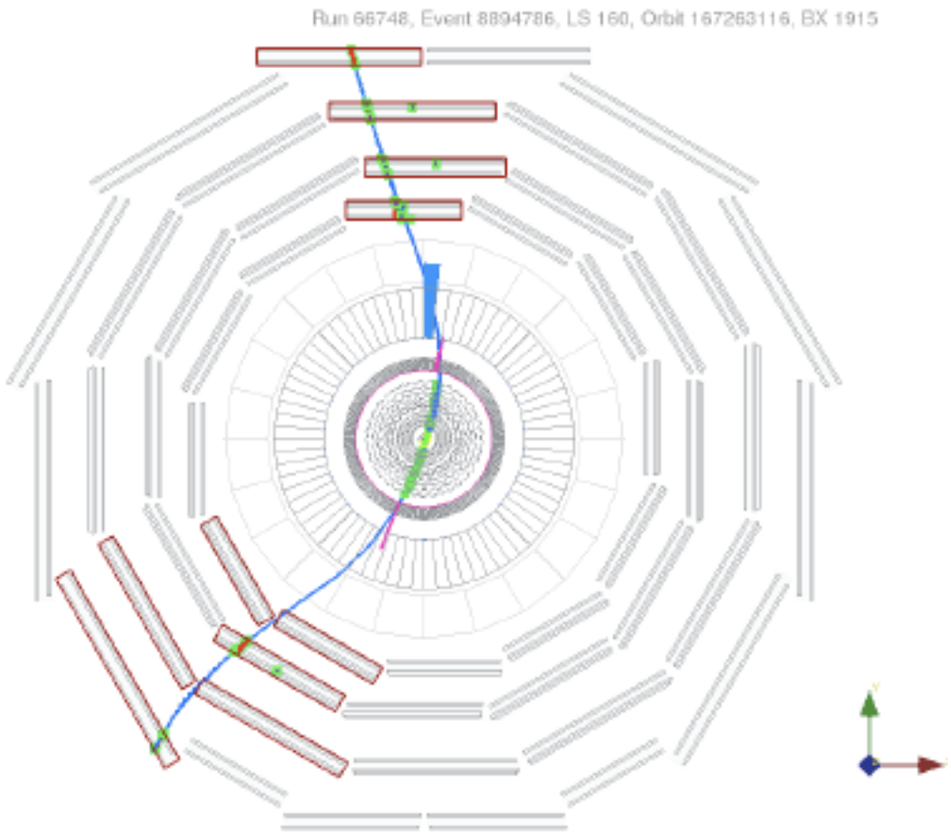
- CMS opened in December 08.
- CAVERN activities on schedule.
- Ongoing Muon & HCAL repairs.
  - Muon Barrel Drift Tubes (DT), Barrel and Endcap Resistive PAD chambers (RPC), Endcap Cathode Strip Chambers (CSC) repairs (few per mille of channels) almost complete.
  - DT work on YB-1/2.
  - HCAL HPD swaps completed.
  - Leak detection on YEs and repair ongoing.
- Tracker PP1 work in the shadow (ready by end of April, second one a month later).
- Tracker cooling (this is the critical path for CMS shutdown activities).
- Preshower: installation foreseen by next week at the PLUS end. MINUS end to follow soon.
- Pixel platform being installed. Internal cooling pipe replacement (extra safety margin) and minor repairs. Will be re-installed at the end of April.

CMS 2009 schedule

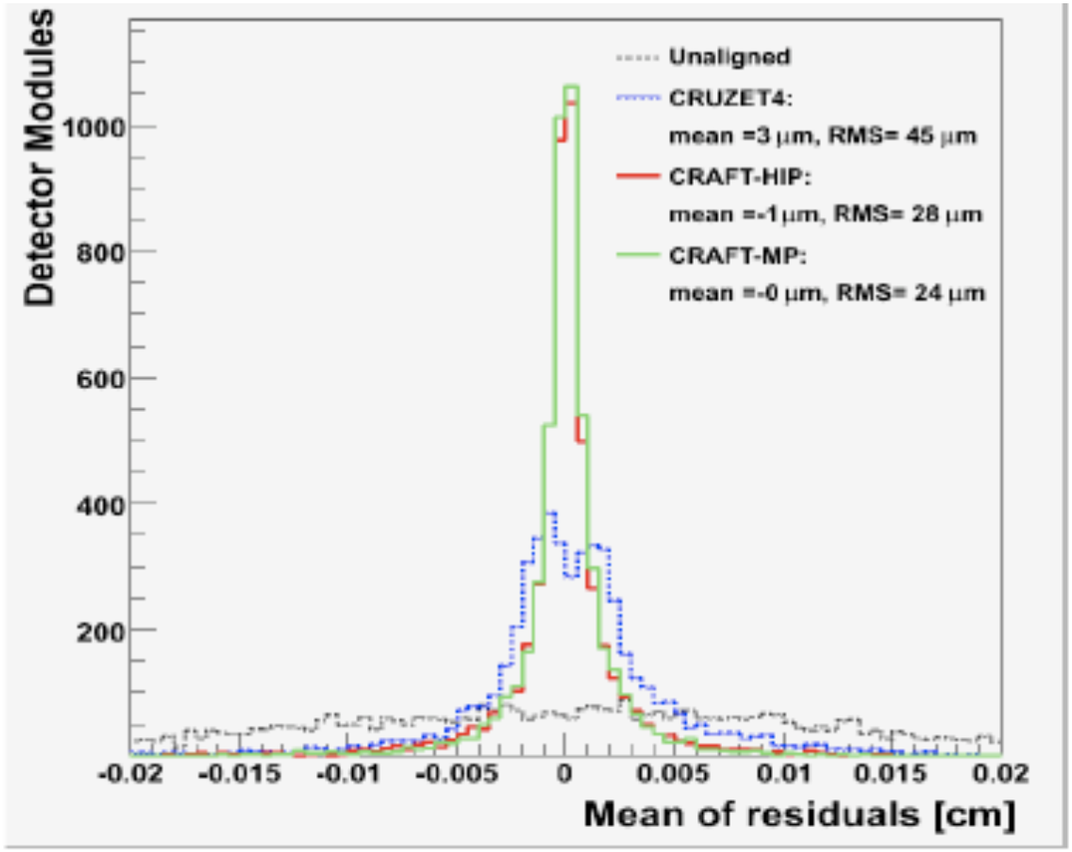
(Proposed last Friday by the CMS Run co-ordinator)

- **Midweek global runs to start in March (first run on 4-5 March) with partial detectors' participation:**
  - Data Acquisition (DAQ) & High Level Trigger (HLT).
  - L1 trigger.
  - Electromagnetic Calorimeter (ECAL) & Hadron Calorimeter (HCAL).
  - Muon detectors: RPC (RB, RE+), CSC (all but ME4+), DTs(#?).
- **More MW runs to follow (proposal for 7 more until the end of May).**
- **CMS closed by end of May.**
- **CRUZET (Cosmic RUn at ZEro Tesla) in early June and beginning of July.**
- **CRAFT (Cosmic Run At Full Tesla) in July and almost continuous running with 2-3 week interruption for cooling maintenance.**
- **Beam mode 2 weeks before circulating beam.**

CMS commissioning w/o beam



Tracker Outer Barrel alignment



- Despite the (very unfortunate) LHC delay, CMS is being commissioned with real data from the cosmic runs (355M events, 277M with magnetic field ON).
- Precious lessons for alignment, synchronisation of sub-systems, trigger, noise, magnetic field, data operations, etc.
- Development of more realistic MC simulation.

Outlook

➡ LHC is set to be operational in late October 09.

➡ Physics run with p-p collisions @ 10 TeV CM energy until the end of 2010 (~300pb^{-1}).

➡ CMS service operations on schedule.

➡ CMS will be closed in the end of May 09 and cosmic runs will take place until mid September (2 weeks prior to beams' circulation in LHC).

➡ Ongoing intensive analysis of 2008 CRAFT data has boosted our understanding of the CMS detector.